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For: FREQUENCY HOPPING OFDMA METHOD USING SYMBOLS OF COMB PATTERN

Enclosed are the following documents: Pages 46 and 48 of the specification

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band is not a power of 2.

If the number N of sub-carriers in the frequency band is $2^{n-1} < N < 2^n$, it means $N=\sum_{i=0}^{n} a_i 2^i$ ($a_i, i=0,\cdots,n$), a_i,i being an integer that is not negative. In this case, a multiple tree can be formed with respect to the number N of sub-carriers by forming $\sum_{i=0}^{n} a_i$ trees T_{2^i} with respect to $i=0,\cdots,n$.

Fig. 28A is an exemplary diagram showing a multiple tree formed of five sub-trees, $ST_1=T_{1024}, ST_2=ST_3=T_{256}, ST_4=ST_5=T_{128}$ (2^7=128, 2^8=256, 2^{10}=1024), when N' is 2048 and N is 1792 (N'=2048 and N=1792) and $a_{10}=1, a_8=2, a_7=2$ (the remainder a_i=0).

Fig. 28B is an exemplary diagram showing a multiple tree formed of 14 sub-trees, $ST_i=T_{128}, (i=1,\cdots,14)$ (2^7=128), when N' is 2048 and N is 1792 (N'=2048 and N=1792) and $a_7=14$ (the remainder a_i=0).

In order to discriminate the comb symbols corresponding to the nodes of different sub-trees, Equation 2 is re-defined as Equation 11:

$$X_{st,N_c,q}(k)\begin{cases}\neq 0, & k = pN_c + q + K_{st} \\ = 0, & \text{Others}\end{cases} \qquad \text{Equation 11}$$

wherein st denotes a sub-tree index;

K_{st} denotes a beginning frequency index of a sub-tree;

$p = 0,1,\ldots,(N_{st}/N_c)-1$, N_{st} being the number of sub-carriers in a sub-tree; and

$q = 0,1,\ldots,N_c-1$.

Apparently, Figs. 28A and 28B and Equation 11 show that the comb symbols of different sub-tree nodes are orthogonal to each other. Therefore, comb symbols formed of many sub-carriers can be allocated to mobile stations without frequency collision by applying the method of Fig. 26 to each sub-tree and allocating frequency resources.

Also, if $\sum_{i=0}^{n} a_i$ is a large value, the number N of the sub-carriers in the entire frequency band is defined by $N=\sum_{i=0}^{n} b_i 2^i$ to reduce the number of sub-trees. That is, $\sum_{i=0}^{n} a_i$

a positive integer and the number of sub-carriers, Nr, may be defined as $Nr = \sum_{i}^{n} c_i 2^i$ ($c_i, c_i = 0$ or 1 $i = 0, \ldots, n$). So, in case that $c_i = 1, i = 0, \ldots, n$, $\sum_{i=0}^{n} c_i$ comb symbols are formed and X_{2^{n-i}, d_i} comb symbols, each having Nr sub-carriers, can be allocated to the mobile stations.

As described in Figs. 28A to 28C, even when the entire sub-carriers are formed in a multiple-tree structure, comb symbols each having Nr sub-carriers are allocated to the mobile stations. Also, in order to acquire frequency diversity, i ($c_i = 1, i = 0, \cdots, n$) can be picked up from all sub-trees. Moreover, to minimize the partial FFT computation amount at the receiving end, if possible, comb symbols $X_{st_1, Nc_1, d_1}, \cdots, X_{st_m, Nc_m, d_m}$ extracted from a plurality of sub-trees are allocated to have the same frequency interval while maintaining N_{c_1} at a fixed value. Preferentially, comb symbols that are extracted from two adjacent sub-trees and whose interval between the frequencies at both ends is the same as the interval between the two comb symbols are allocated.

Fig. 29 is an exemplary diagram showing 352 sub-carriers allocated to one mobile station in the multi-tree structure of Fig. 28A. 352 is a summation of 256, 64 and 32 (352 = 256 + 64 + 32). The sub-trees are allocated to a sub-tree 1, a sub-tree 3, and a sub-tree 5. Then, the comb symbols having the same frequency interval are allocated to thereby minimize the amount of partial FFT computation.

Fig. 30 is a diagram describing a frequency hopping method where all comb symbols of a cell perform frequency hopping in the frequency domain according to a frequency hopping pattern to thereby avoid collision between the symbols having different size. It explains a method of performing orthogonal frequency hopping on the comb symbols allocated to the mobile stations of a cell in the frequency area through the methods of Figs. 26, 28A, 28B and 28C.

In case that comb symbols allocated to the mobile stations in a cell are grouped according to their size, the amount of partial FFT computation at the receiving end can

PAGE 3/3 * RCVD AT 3/17/2009 3:55:47 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-6/34 * DNIS:2736044 * CSID:3108205988 * DURATION (mm-ss):00-46